Calibrating an Active Network Node

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1 – Introduction

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What is an active network ?

- Active networks allow users, to inject mobile code into the nodes of the network. These *active applications* (AA) run inside virtual execution environment (EE).
- Need for management and quantification units for the resources :
  - bandwidth (bytes/seconds)
  - memory (bytes)
  - CPU processing (?)

1 – Introduction

Why the need of calibration ?

- We have defined
  - stochastic model for an AA on node A
  - transform from node A to node B
- we can express the CPU time consumption in terms of a reference node.
- calibration = gathering metrics relative to a platform, to scale a model for an AA to that platform.
- *how background load affects the results of a calibration ?*

2 – Model for an active application

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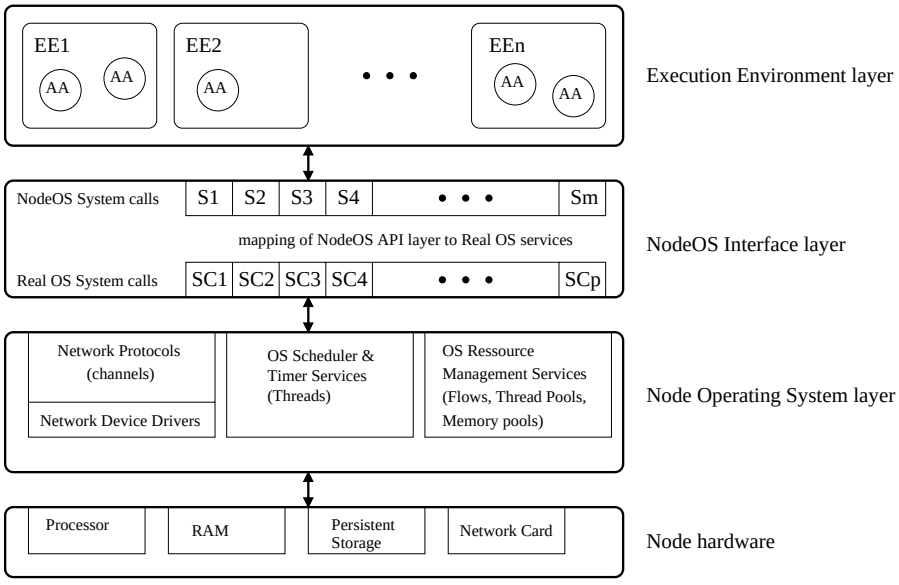
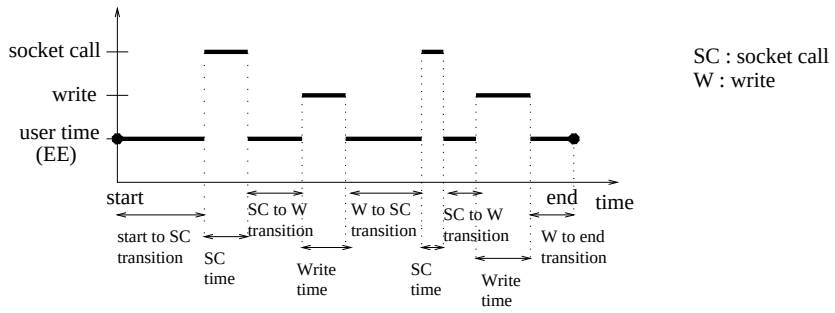
Conceptual architecture of an AN node



2 – Model for an active application

Description of the model



The model is composed of :

- the list of the possible paths (sequence of SC), with their probability of occurrence
- for each SC and each transition, the distribution of the dwell CPU time (as a histogram)

The model is instantiated for a given AA, EE and host.

2 – Model for an active application

Scaling the model from one platform to another

- For a given AA, the model depends on :
  - the performance of the SC of the node OS
  - the performance of the EE
- The goal of the calibration is to provide estimations of these performances.
- In the following, we treat separately the calibration of
  - the node OS (performance of each SC provided by the node OS)
  - the EE (performance of the AA when in user space)

3 – Calibration of an Active Node OS

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Method

	node A	*node B*
CPU	pentium II - 333 Mhz	pentium II - 450 Mhz
RAM	128 Mbytes	128 Mbytes
storage	SCSI hard drive	IDE hard drive
OS	linux 2.2.7	linux 2.0.36
EE	ANTS 1.2 on jdk1.1.6	ANTS 1.2 on jdk1.1.7B

- We measure a calibration workload that makes call to all the SC provided by the node OS.
- Measurements with : no background load, computation load, input/output intensive load, and memory consuming load.

3 – Calibration of an Active Node OS

Results

Node	Call	no load	comp 10	I/O 10	mem 5
node A	close	7	8	8	9
	link	22	23	23	26
	open	11	13	12	13
node B	close	9	9	10	9
	link	32	32	33	35
	open	32	34	34	61

Table 1: Time in μs spent in system calls, while varying the background load

4 – Calibration of an Execution Environment

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Method

- We measured the EE while running an AA : active ping or active multicast.
- Measurements made in the same conditions as for node OS calibration :
  - no background load
  - a computation load
  - an input/output intensive load
  - a memory consuming load

4 – Calibration of an Execution Environment

Results

Node	Application	comp 10	I/O 10	mem 5
node A	ping	+ 3.2 % (+ 1.2 cs)	- 3.2 % (- 1.2 cs)	+ 1.3 % (+ 0.5 cs)
	multicast	+ 2.0 % (+ 2.3 cs)	+ 0.9 % (+ 1.0 cs)	- 1.3 % (- 1.5 cs)
node B	ping	0 % (0 cs)	- 0.6 % (- 0.2 cs)	+ 67 % (+ 21.3 cs)
	multicast	+ 5.2 % (+ 5.3 cs)	+ 6.1 % (+ 6.1 cs)	+ 20.7 % (+ 20.9 cs)

Table 2: Relative and absolute (measured in centiseconds) increase of the measurements with a background load, compared to the case without any load

5 – Conclusion

- We have investigated a method to calibrate active network nodes in order to scale a model for CPU time usage by active applications.
- We have shown that the calibration process is not significantly affected when competing with a computation and I/O intensive background load.
- It is different with a memory consuming load.
- That implies to be cautious when performing the calibration. The background load should be removed if it is too memory consuming, so as to avoid disk swapping, unless the burden of the swapping can be taken care of by another device than the CPU.

5 – Conclusion

http://w3.antd.nist.gov/active-nets/

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